UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION I
1 CONGRESS STREET, SUITE 1100 (HBT)
BOSTON, MASSACHUSETTS 02114-2023

Memorandum

Date: August 27, 2014

Subj: Remedial Action Complete – Operable Unit 1
Naval Weapons Industrial Reserve Plant, Bedford, MA

From: Matthew R. Audet
Remediation and Restoration II Branch

Thru: Mary Sanderson, Chief
Remediation and Restoration II Branch

To: File

The Site: NWIRP Bedford is located in the Town of Bedford in Middlesex County, Massachusetts, approximately 15 miles northwest of Boston. The 46-acre facility is owned by the U.S. Government (Navy) and was previously operated by the Raytheon Company of Waltham, Massachusetts, from its inception during the mid-1950s until December 2000. The mission of NWIRP Bedford was to design, fabricate, and test prototype equipment for missile guidance and control systems. Activities at NWIRP Bedford historically were conducted in two main structures: the Components Laboratory north of Hartwell Road and the Flight Test Facility to the south. The property has remained vacant since that time, except for the Navy's operation of a groundwater extraction and treatment system as an interim remedial action for OU1 from 1997 to present. The Components Laboratory area is believed to be the source area for the OU1 chlorinated solvent groundwater plume.

OU1 is located in the "Northern Activity" of NWIRP Bedford (i.e., the property north of Hartwell Road), where elevated chlorinated volatile organic compound (CVOC) concentrations were detected in groundwater. Site-specific constituents of concern (COCs) include the following CVOCs: 1,1-dichloroethene (DCE), 1,1-dichlorethane (DCA), 1,2-DCA, cis-1,2-DCE, 1,1,2-trichloroethane (TCA), tetrachloroethane (PCE), trichloroethene (TCE), and vinyl chloride. TCE is the predominant COC, based on its extent and associated risks. CVOCs in groundwater are migrating mainly west/northwest from a source area located under Hartwell's Hill (north side the Components Laboratory toward Elm Brook). In 1992, the Navy pursued the evaluation, design, and implementation of a Short Term Measure (STM) (groundwater extraction and treatment) to contain the migration of CVOCs. The STM was continued as an Immediate Response Action (later termed an Interim Remedial Action, or IRA) and has been operating since March 1997. From 1997 to present, the Navy conducted LTM of CVOCs in groundwater as part of the IRA to track the OU1 plume and evaluate the effectiveness of the groundwater pump-and-treat system.

OU1 Plume

The Remedy: In September 2010, the Navy and U.S. Environmental Protection Agency (EPA) signed a record of Decision (ROD) for OU1. The Remedial Action consisted of in situ enhanced bioremediation of the source area, continued operation of the existing groundwater pump-and-treat system for plume capture and control, land use controls (LUCs), and MNA/LTM of the plume. This action included the construction of 24 remedial system injection wells, injection lines, source area distribution piping and the skid-mounted injection system located within the existing onsite groundwater treatment plant (GWTP).

RAOs for OU1 are as follows:

- Mitigate the identified unacceptable risks to human health associated with the use of OU1 groundwater as a drinking water supply by reducing concentrations of COCs in groundwater to cleanup levels.

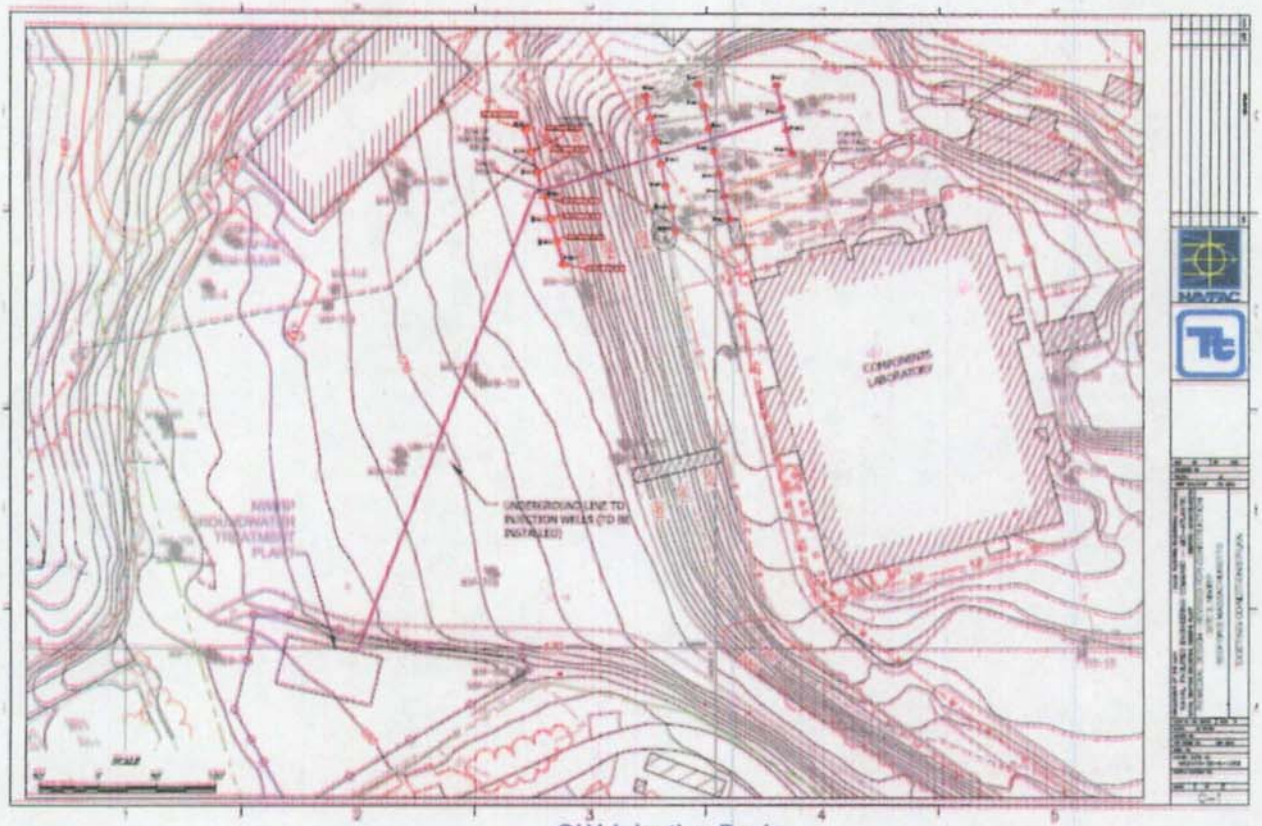
- Prevent the use of onsite groundwater for human consumption until groundwater cleanup levels have been achieved onsite.

- Prevent the migration of COCs in groundwater at concentrations greater than cleanup levels. Cleanup levels for OU1 groundwater were selected as the more stringent standards of the federal and state drinking water Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs):

1,1-dichloroethene (1,1-DCE)	7µg/L
1,2-dichloroethane (1,2-DCA)	5 µg/L
cis-1,2-dichloroethene (cis-1,2-DCE)	70 µg/L
tetrachloroethene (PCE)	5 µg/L
trichloroethene (TCE)	5 µg/L
vinyl chloride (VC)	2 µg/L

Source Area: Initial site mobilization commenced on July 23, 2012 with injection well installation and development beginning on August 27, 2012. The following injection wells were installed in four rows using sonic drilling technology in accordance with the Final Design Drawings and Specifications (Tetra Tech, 2012):

- Row A (IW-A1 through IW-A7), immediately downgradient of the OU1 source area.
- Row B (IW-B1 through IW-B4, IW-B6, and IW-B7), within the OU1 source area. Existing test well TW-1 was converted to injection well IW-B5, and a new well was not installed at this location, as documented in RFI 002 (Appendix B).
- Row C (IW-C1 through IW-C7), within the OU1 source area.
- Row D (IW-D1 through IW-D4), adjacent to the OU1 source area.



OU1 Injection Design

AGVIQ-CH2M HILL personnel began underground trenching and pipe installation on September 10 and continued through October 23, 2012. Following removal of the original asphalt and trench excavation, field piping was installed on 4 inches of sand bedding in trenches approximately 3 feet bgs. The piping consisted of high-density polyethylene (HDPE), SDR 11 piping with 230 psi pressure rating. The main line from the GWTP location to Row A wells is approximately 500 feet long and also constructed of 1-inch diameter HDPE, SDR 11piping with 230 psi pressure rating. The headers to the injection well rows are constructed from ¾-inch diameter HDPE, SDR 11 piping with 230 psi pressure rating.

Injection equipment, instrumentation, and the control system that would interlock with the existing GWTP system controls were installed per the specifications of the Basis of Design for OU1 (Tetra Tech, 2012). Overall system installation and testing ran from August till October 2012 with demobilization concluding on November 21, 2012.

Startup activities for the OU1 In-Situ Bioremediation system were conducted beginning November 14, 2012, and concluded with on Tuesday, November 27, 2012. The system employs anaerobic reductive dechlorination (ARD) as the primary biological degradation process to treat the COCs in the OU1 source area and transform cVOCs to innocuous compounds such as carbon dioxide, ethene, ethane, and chloride. Full-scale implementation of the remedial design includes the application of an electron donor (carbon) substrate throughout the source area from approximately 5 feet below the top of the groundwater table approximately 25 feet below ground surface [bgs]) to a depth of approximately 60 feet bgs. To date, approximately 500 gallons of Lactoil have been successful injected into the aquifer.

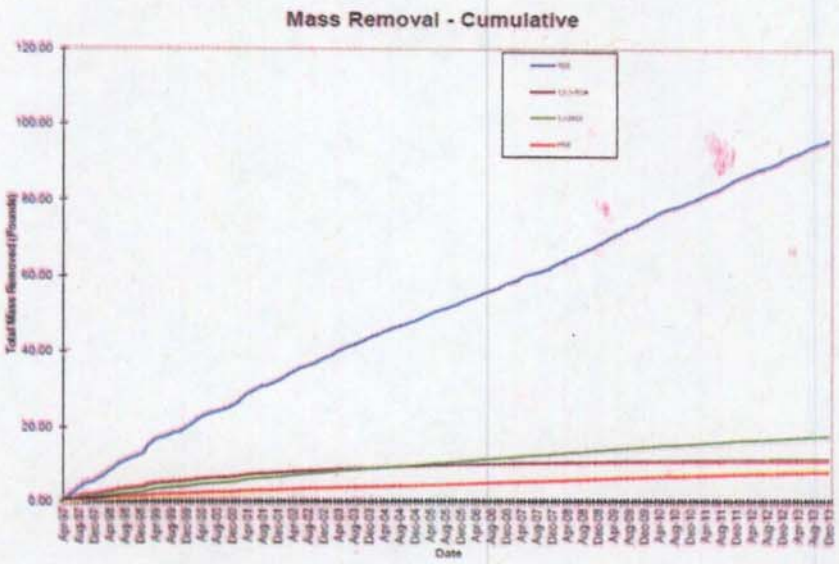
Successful indicators of reductive dechlorination typically include increases in TOC, methane, sulfide, VFAs, and functional genes (which indicate the presence of microorganisms capable of degrading COCs); and decreases in DO, ORP, sulfate, and nitrate. October 2013 groundwater data indicate that favorable conditions are being created, but there is limited data to indicate the presence of substrate in most of the treatment area, as seen through lack of increasing TOC, VFA, and functional gene concentrations. Indicative trends are as follows:

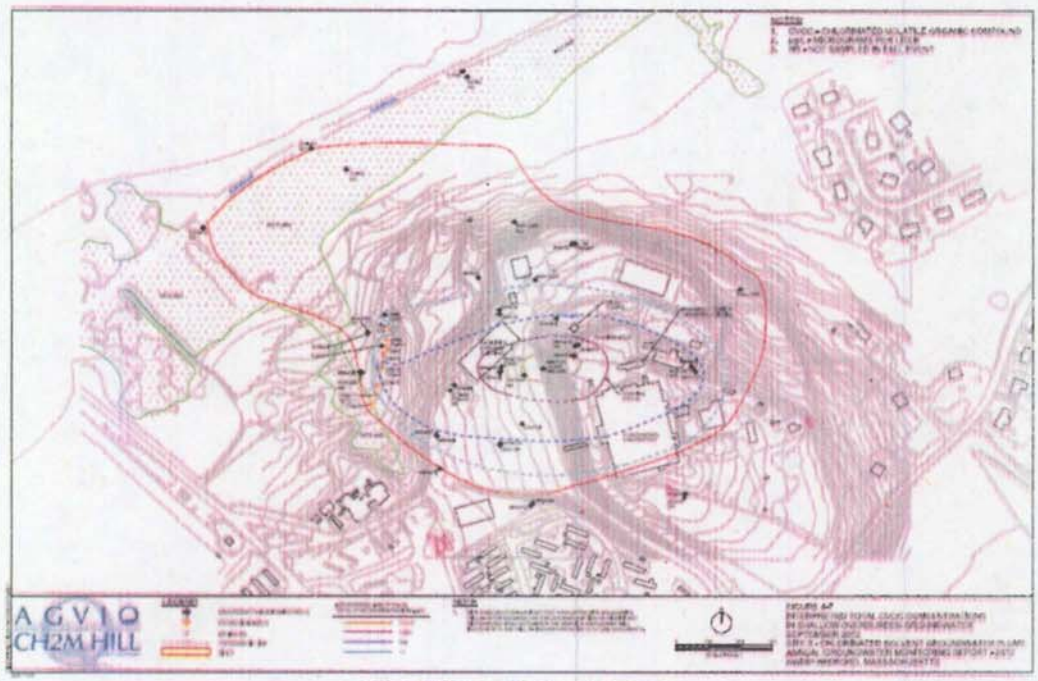
- TOC concentrations in wells MW-52I and MW-54I increased from the first to the second quarterly performance monitoring event, but these were the only two wells at which TOC was greater than 20 µg/L, the concentration considered necessary to support reductive dechlorination.
- Methane concentration increased significantly in all wells for which it was analyzed.
- Sulfide and VFA concentrations have been variable in all performance monitoring wells.
- Readings at all monitoring wells exhibited low DO concentrations (under 1 mg/L) and negative ORP values.
- Sulfate concentrations decreased at seven of the eight performance monitoring wells, with the exception of MW-13S.
- Nitrate concentrations remained below laboratory reportable concentrations in all but two wells (MW-59I and MW-67I), both of which were detected at low levels in October 2013. Nitrate has generally been below laboratory reporting levels in all performance monitoring events.

An estimated 250 gallons of substrate remain to be injected of the initial round. Quarterly performance monitoring continues and the need for additional rounds of injection will be evaluated based on these and other data trends.

Data collected to evaluate the Groundwater Extraction and Treatment System indicate cumulative mass removal as of January, 2014 is 133.49 lbs of VOCs based on 500,000 gallons of influent per month.

CVOCs remain at concentrations exceeding the cleanup goals in groundwater samples. Elevated COC concentrations remain at wells (MW-12R, MW-12S, MW-13R, MW-20R, and MW-21R) located near the OU1 source area. Thirteen of the 22 sampled monitoring and extraction wells have one or more COC concentrations that exceed cleanup goals, and eight of those wells (BG-1B, MW-12R, MW-12S, MW-13R, MW-13S, MW-14R, MW-20R, and MW-21R) are located on Navy property, while four wells (EW-01, EW-04, EW-15, and EW-21) are in the extraction well area north of the facility boundary.





OU1 Plume Concentrations

Migration Area: Current monitoring activities at OU1 consist of semi-annual groundwater sampling, in accordance with the 2010 ROD and the Final SAP (AGVIQ-CH2M HILL, 2012), which have been conducted in accordance with this schedule for 2 years (2011 to 2012). LTM of cVOCs in groundwater and MNA assessments are performed to verify that the overall plume is attenuating at an acceptable

rate. In 2012, groundwater samples were collected from March 28 to May 2, 2012 and from September 24 to October 1, 2012. In addition to the collection of cVOC and MNA data, water quality parameters (pH, specific conductivity [SpC], dissolved oxygen (DO), oxidation reduction potential [ORP], temperature, and turbidity) were monitored during the well purging using water quality meters. In April 2012, surface water samples from three locations along Elm Creek adjacent to existing monitoring wells were collected to evaluate whether surface water quality in Elm Brook or the associated wetland within OU1 are being adversely impacted by COCs. Two of OU1 COCs, cis-1,2-DCE and TCE, were detected in the surface water samples, but neither exceeded their applicable cleanup goals. There was no significant change in total cVOC concentration in the majority of OU1 wells indicating that natural attenuation, in conjunction with the extraction system, is largely controlling plume stability.

Land Use Controls

Specific Land use Controls (LUCs) objectives at OU1 are:

- Prohibit use of the OU1 groundwater aquifer as a drinking water supply until groundwater COC concentrations achieve cleanup goals.

- Prohibit residential redevelopment of the OU1 property until a CERCLA risk assessment is performed to quantitatively demonstrate that OU1 soil poses no unacceptable risks to future residents.

- Restrict occupancy of current and future OU1 structures until a CERCLA risk assessment is performed to quantitatively demonstrate that vapor intrusion from OU1 soil poses no unacceptable risks.

As set forth in the LUC RD, the following implementation actions will be performed to ensure that LUC objectives are met in accordance with the FFA, ROD, and the ESD:
1. Prepare a map defining the OU1 LUC Area boundaries. Indicate where LUCs have been imposed and annotate LUCs in the Navy Geographic Information System (GIS) database and real estate summary map(s) for the installation, and follow LUC-related procedures pertaining to ground-disturbing activity and changes in land use, as per Commander, Navy Region, Mid-Atlantic Instruction 5090.2, *Installation Restoration; Land Use Controls at Navy Region, Mid-Atlantic Installations; Establishment and Maintenance*, as amended (Appendix A). The Navy will notify EPA and the Commonwealth of Massachusetts in advance of any changes to internal procedural instructions that would impact the effectiveness of the LUCs.

2. Submit a copy of said map to the land record offices of the Town of Bedford, Massachusetts, and a listing of LUCs that have been imposed, for the limited purpose of providing public notice of the environmental conditions of and limitations on the use of property. Additionally, copies of this map will be provided to EPA and the Commonwealth of Massachusetts.

3. Monitor compliance with the LUCs. LUC monitoring will be coordinated with the O&M and groundwater monitoring programs. LUC monitoring will be conducted by the Navy to verify LUCs are being properly implemented and that the LUC objectives are being met. The LUC monitoring results will be provided to the EPA Region 1 and the Commonwealth of Massachusetts annually. LUC compliance inspections will be conducted on an annual basis unless the frequency is reduced by agreement with the Navy, EPA, and the Commonwealth of Massachusetts. Checklists to be used for OU1 during LUC inspections are provided in Appendix B of the LUC Remedial Design.

4. Report and notify regulatory agencies. The notification requirements include the following:

a. Notify EPA Region 1 and the Commonwealth of Massachusetts 45 days in advance of any proposed change in land use that would require modifications to the LUCs to remain consistent with the LUC objectives or the selected remedy. The notice shall describe how the LUCs will be changed and mechanisms by which the new LUCs will be implemented to maintain the protectiveness of the remedy.

b. Notify EPA Region 1 and the Commonwealth of Massachusetts by telephone and by e-mail as soon as practicable, but within 10 working days, after discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. Notify EPA Region 1 and the Commonwealth of Massachusetts regarding how the breach will be or has been addressed within 10 days of sending EPA Region 1 and the Commonwealth of Massachusetts the discovery notification of the breach activity. For more complex breach situations, a telephone call within this 10-day period among Navy, EPA, and the Commonwealth of Massachusetts to discuss options for addressing the breach will be considered sufficient to meet this notification requirement. Furthermore, any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs will be addressed as soon as practicable, but in no case will the process be initiated later than 10 days after the Navy becomes aware of the breach.

c. Notify the EPA Region 1 and the Commonwealth of Massachusetts in writing at least six months prior to any anticipated transfer or sale of the property subject to LUCs out of Navy custody and control, including any federal-to-federal transfer, so that EPA Region 1 and the Commonwealth of Massachusetts can be involved in discussion with the Navy on the appropriate provisions to be included in the transfer terms and conveyance documents to maintain effective LUCs. If it is not possible for the Navy to notify EPA Region 1 and the Commonwealth of Massachusetts at least six months prior, the Navy will make this notification as soon as possible, but no later than 60 days before the transfer or sale of any property subject to LUCs. The Navy shall provide a copy of the executed deed or transfer documents to EPA Region 1 and the Commonwealth of Massachusetts.

d. Submit reports of annual monitoring. LUC compliance monitoring shall be conducted annually and the results submitted to the EPA Region 1, the Commonwealth of Massachusetts, and the Town of Bedford Board of Health. The annual reports will be used in preparation of the five year reviews to evaluate the effectiveness of the remedy. The LUC portion of the annual report will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The LUC portion of the annual report will also address whether Navy instructions remain current in regards to LUC enforcement, and whether use of the property has conformed with such restrictions and controls.

5. Obtain EPA Region 1 concurrence, in consultation with the Commonwealth of Massachusetts, prior to modifying or terminating the LUCs or implementation actions. The Navy or other entity shall seek prior concurrence from EPA Region 1, in consultation with the Commonwealth of Massachusetts, before taking any anticipated action that may disrupt the effectiveness of the LUCs or before taking any action that may alter or negate the need for LUCs.

6. Evaluate the effectiveness of LUCs as part of each five-year review. Site remedy reviews are required by the CERCLA and the National Contingency Plan, as specified by the OU1 ROD and ESD. The first five-year review will be completed in 2014 and will include an evaluation of the OU1 remedy.

Five-year reviews will be submitted to EPA Region 1 and the Commonwealth of Massachusetts for review per the FFA.

7. For private properties within the OU1 LUC boundary, continue to coordinate with the Town of Bedford Board of Health and monitor the Town's implementation of the municipal Code of Health Regulations which control the installation and use of private water wells. Also continue to coordinate with the Town to monitor any proposal to develop for residential use any of the privately-owned property within the OU1 LUC Area. In this instance, the Navy will then confer with EPA Region 1 and the Commonwealth of Massachusetts to determine what further actions may be necessary, if any, to protect human health and the environment at that time. Should the Navy fail to complete a required LUC implementation action, EPA shall notify the Navy Remedial Project Manager (RPM) and seek immediate action. If the Navy fails to complete a required LUC implementation action within a reasonable time of being so notified, EPA may notify the Deputy Assistant Secretary of the Navy (Environment), who will ensure that necessary action is taken. Should a subsequent owner of or a third party at OU1 property fail to complete a required LUC implementation action for which such owner or party is responsible, EPA and the Navy will consult on the appropriate enforcement action. If after the property has been transferred, the Navy fails to complete a required LUC implementation for which it is responsible, EPA will notify the Navy RPM or designated project manager, per Section XIV in the NWIRP Bedford FFA. If necessary, EPA may notify the Deputy Assistant Secretary of the Navy (Environment), who will ensure that necessary corrective action is taken.

In accordance with the above LUCs, annual LUC inspections (Tetra Tech, December 5, 2011, October, 3, 2012, October, 24, 2013) indicate compliance with conditions set forth in the ROD. The Navy will maintain institutional controls at OU1 until the concentrations of hazardous substances have been reduced to levels that allow for unlimited exposure and unrestricted use, as determined by the monitoring program.

Monitoring

The ROD described the NWIRP OU1 monitoring network as follows:

> Substrate application may be achieved through a series of new and existing injection wells situated in a grid layout across the source area (e.g., FS assumed a total of 64 injection wells), or as a series of treatment zones through which source area groundwater would flow. [...] The existing monitoring well network will be augmented with additional nested groundwater wells installed in the treatment zone to monitor the effectiveness of bioremediation over time (e.g., FS assumed 15 wells in the source area).

Accordingly, the Navy conducted pilot tests in Nov. 2010 and Nov. 2011. Results of which are presented in Appendix C and G of the Remedial Design, respectively. Based on the results of the pilot tests, it was determined the Navy could proceed with the second option (i.e., the series of treatment zones) using 25 permanent injection wells instead of 64 DPT points. Determination was also made that existing monitoring wells could be used, with the addition of one new well installed downgradient of the treatment zone (page 3-15 of the Jan. 2012 Remedial Design). The new well (MW-76S) was installed in October 2012.

The overall LTM/MNA program as described in the ROD (pg 26) includes semi-annual sampling of up to 46 wells to evaluate the nature extent of the treated plume over time and the ability of the extraction wells to manage migration. The Navy's contractor will be issuing a SAP for LTM work in the near future. Discussions have indicated that a few additional wells will be installed in the wetland area

between the extraction wells and Elm Brook to better evaluate the front of the plume. Prior to this, however, the Navy will conduct discrete interval groundwater sampling to ensure new wells are screened at the correct interval. The Navy is currently preparing a work plan to do this discrete interval sampling.

Conclusion

A site inspection was conducted on September 23, 2013 to verify site conditions. All ROD elements have been successfully completed and LUCs established as documented in the Final Construction Completion Report, dated February, 2014. Accordingly, EPA concludes that the Navy has satisfied the requirements for Operable Unit 1 Remedial Action Completion at Naval Weapons Industrial Reserve Plant, Bedford.

ROUTING AND TRANSMITTAL SLIP

Date: 8/27/14

TO: (Name, office symbol, room number, building, Agency/ Post)	Initials	Date
1. Matt Adgt		8/27
2. Lynne Jennings		8/28/14
3. Mary Sanderson		8/28/14
4.		
5.		

	Action		File		Note and Return
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	As Requested		For Correction		Prepare Reply
	Circulate		For Your Information		See Me
	Comment		Investigate		Signature
	Coordination		Justify	X	Initial

REMARKS

Naval Weapons OU1 Remedial Action Completion Memo for Approval/Initial. This memo approves the Final Construction Completion Report & Remedial Construction Activities* satisfying the RA Complete @ NWIRP OU1. -MAA

ATTACHED

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/ Post)	Room No. — Bldg.
Matt Adgt	OSRR-07-03
	Phone No. - 81449

5041-103

OPTIONAL FORM 41 (Rev. 1-94)
Prescribed by GSA
UNICOR FPI - SST

Final
Construction Completion Report
Remedial Construction Activities
Site 3 Chlorinated Solvent Groundwater Plume and Site 4 BTEX Plume

Naval Weapons Industrial Reserve Plant
Bedford, Massachusetts

Revision No. 01

Contract N62470-08-D-1006
Task Order Nos. WE14 and WE25

Submitted to:

NAVFAC
Naval Facilities Engineering Command

U.S. Naval Facilities
Engineering Command
Mid-Atlantic

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February 2014

CONCURRENCES

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